of a classified synopsis, whereby the serial positions of all the genera and species might be seen at a glance. In all other respects we heartily congratulate Mr. Hay on the completion of such a valuable and heavy piece of palæontological work. R. L.

APPLIED GEOGRAPHY.

Applied Geography. By Dr. J. Scott Keltie. Pp. viii+199. Second edition. (London: G. Philip and Son, Ltd., 1908.) Price 2*s.* 6*d.*

SINCE the appearance of the first edition in 1890, this work has been recognised as an authoritative and coherent statement of human industry and progress from the point of view of geography. The demand for a new edition has provided the opportunity for a thorough revision of the work, involving the addition and consideration of new material now available; and the result is a volume in which the dry bones of what is known as commercial geography are articulated so that their relationship to each other, and to the life of man, can be clearly distinguished.

It is sometimes said that geography is not a science; and in so far as it deals only with the collection of facts there is justification in the remark. No branch of natural knowledge can claim a place in the hierarchy of the sciences until the facts with which it is concerned have been classified, generalised, and shown to lead to productive principles. In the past, geographers themselves have not realised that this is the ultimate aim and intention of scientific investigation, and have mostly been content with the accumulation of facts without attempting to construct an organic system from the material. Few have worked on Baconian principles with the object of discovering by systematic inquiry the true significance of the facts.

That definite principles can be deduced from geographical material is illustrated by many statements in Dr. Keltie's book. Consider, for instance, the relation of rainfall to population and to animal and vegetable commodities. Neglecting the local influence of minerals, manufactures, and transport, it may be said that population is relatively low where the rainfall is deficient or excessive, and high where rainfall favours the growth of grass, grain, and other food products. The density of population in many parts of India is in exact proportion to the rainfall, and the number of sheep that can be grazed per square mile in Australia also varies with the rainfall, being at the rate of twenty-two sheep per square mile for every inch of rain above nine inches. Wheat also shows a similar relationship, the harvest in South Australia being on the average 12.5 bushels per acre for a rainfall of 18.5 in., 10 bushels for 15 in., and 6.5 bushels for 13.5 in. An extra inch of rain in the season would thus represent in South Australia a gain of about 10,000,000*l.* These are examples of geographical principles derived from the coordination of meteorological and economic data by scientific inquiry.

Though Dr. Keltie gives many similar instances of the relation of various factors of climate to the products and commercial value of a country, he omits to mention that the distribution of rainfall through the year is more important than the actual amount. Grass lands require not only an annual rainfall of about thirty inches, but also a distribution of this quantity throughout the year at intervals not exceeding a month. Wheat-growing also depends upon the distribution; and with some varieties can only be successfully carried on where the percentage of winter rains is largely in excess of that for the summer months. Given the meteorological conditions and the character of the soil in any part of the world, it is possible to state what variety of wheat will come to maturity there, or whether the region is unsuited to wheat culture. Here then we have the facts of meteorology, agriculture, botany, and economics, leading to a conclusion of high significance to the human race; and it is only one of many examples of applied geography.

"From neglect or ignorance of known geographical conditions," says Dr. Keltie, "or from taking no steps to counteract them, the most serious disasters to crops and flocks were of constant occurrence in Australia, though, recently, improvements have been introduced. It is, therefore, the most short-sighted policy imaginable in a young colony to neglect the survey of its territories; public money cannot be better spent than in the maintenance of an efficient survey service, and a carefully selected network of meteorological stations."

Man is, of course, able to modify natural conditions or adapt his demands to them. Irrigation has converted barren land into fertile fields; insanitary and malarious regions have been rendered habitable as the result of biological observation and experiment; and hindrances to commerce have been overcome by engineering enterprise. In this connection, the author says, "By deafforesting here and planting there, we have been able appreciably to modify rainfall, and therefore climate." There is, however, little evidence for this belief. No amount of afforestation or deafforestation will modify the direction or frequency of rain-bearing winds; forests do not, in fact, affect greatly the rainfall of a region, but they assist in conserving the moisture actually received, and when they are destroyed the soil may be washed away or the loss by evaporation and percolation increased.

When referring to the relation of man himself to the resources around him, Dr. Keltie remarks, "Had a different type of man from the Chinese, men like ourselves, possessed that vast territory, how different the results would have been." The explanation of undevelopment is not, to our mind, due so much to the type of man as to the beliefs and traditions accepted by the people. The Chinese are as industrious and ingenious as any Western race, and when they awake to the knowledge that the wisdom of the past is insufficient for the needs of to-day and the future they will make even more substantial advances than Japan has done. Until the study of science had been transferred from books and authority to nature by observers like Paracelsus, Leonardo da Vinci, Galileo, Gilbert, and Gesner, Europe was in the dark ages, and the conclusions of Aristotle, Ptolemy, and other sophists were regarded as the final standard of judgment by which the validity of natural fact or theory

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should be tested. Only when independence of observation and thought had been secured by the pioneers of modern science was progress possible. Any race which places the wisdom of its early fathers above the work of its sons, which regards past knowledge as sufficient for future salvation, must remain stagnant. Mr. G. G. Chisholm accurately expresses the application of this fact to China in the "International Geography" in the following words:—

"All Chinese institutions concur in impressing on the people respect for authority and the established order. None is more influential in this respect than the system of examination, for all the examinations test merely the knowledge of the ancient Chinese classics first systematised by Confucius, and give no encouragement to the spirit of independent inquiry."

It would be easy to select numerous other points from Dr. Keltie's book for description or comment. The six chapters in the volume deal respectively with general considerations, geography applied to commerce, the geography of Africa in its bearings on the development of the continent, the British Empire, some common commodities, and the unstaked or unexplored parts of the earth. Each chapter is rich in information, and the style of the whole work is far removed from that of books in general on commercial geography. Our only regret is that a book which embodies so many facts of importance should be published without an index.

QUAIN'S ANATOMY.

Quain's Elements of Anatomy. Edited by Prof. E. A. Schäfer, F.R.S., Prof. J. Symington, F.R.S., and Dr. T. H. Bryce. In four vols. Vol. i., Embryology. Eleventh edition, by T. H. Bryce. Pp. viii+275. Price 10*s.* 6*d.* net. Vol. iii., Neurology. By Prof. E. A. Schäfer, F.R.S., and Prof. J. Symington, F.R.S. Part i., containing the General Structure of the Nervous System and the Structure of the Brain and Spinal Cord. Price 15*s.* (London: Longmans, Green and Co., 1908.)

WHEN in 1828 Jones Quain, "Lecturer in the Medical School, Aldersgate Street," published, as a modest volume, the first edition of his "Elements of Anatomy," he could scarcely have hoped that eighty years later it would still remain the standard work of its kind in the English language, and that it would take and keep a place as a cosmopolitan text-book; and yet if the truth must be told, very little of Quain remains in the work which now passes under his name. In the original edition a chapter of some 4000 words told the story of the development of the human body; now, in the eleventh edition, embryology requires a special editor and a special volume containing more than 100,000 words and considerably more than 300 illustrations.

The new edition is marked by a number of changes, some of them of considerable magnitude. Chief amongst these is the change in the editorial staff, and it will be with very sincere regret that anatomists, not only in England, but in every country, will see that Prof. George Dancer Thane's name no longer appears on the title-page. In width and accuracy of anatomical knowledge, in clearness of statement and draughtsmanship, he has no compeer amongst present-day anatomists. Dr. T. H. Bryce, lecturer in anatomy in Queen Margaret College, Glasgow, has joined the editorial staff, replacing Prof. Schäfer as editor of the volume dealing with embryology. The present edition is to appear in four volumes, of which the volume by Dr. Bryce, containing the embryology, is the first; general and visceral anatomy will constitute a second, the nervous system and sense organs a third, the remaining subjects being grouped together in a fourth volume. It is to be hoped that, as in the last edition, each of these remaining volumes will be issued in separate parts, for big volumes are very inconvenient for reference and use. In the present edition the "general introduction" has been wisely omitted, for it shared the character of nearly all introductory chapters in being unintelligible until the whole contents of the work had been mastered and appreciated by the student. It is also to be hoped that the precedent set by the present volume of referring readers to foreign text-books for the literature of the subjects dealt with is not to be followed in the other volumes, although it must be admitted that Dr. Bryce does supply references to important papers of more recent date.

In preparing a new edition of "Embryology," Dr. Bryce's task was not an easy one, and he has done it well. In the eighteen years which have elapsed since the last edition was published there has been a remarkable extension in every phase of our knowledge of the development of the human body. Especially is this true of the early stages in the development of the human embryo and of its attachment to the uterus. The ova described by Leopold, Peters, Beneke, and Graf v. Spee, represent earlier stages than were known when the last edition was published, and it is not improbable that the specimen described by Drs. Bryce and Teacher since the present edition was ready for publication represents a younger stage of the human embryo than has been hitherto seen. Our conception of the manner in which the ovum becomes embedded in, and attached to, the uterus has undergone a complete revolution. The elaborate changes undergone by the nucleus of the cell, especially those nuclear changes which preceed the formation of genital cells, have been recently investigated by a large army of workers, a line of research, if one may judge from the space here devoted to it, with which Dr. Bryce has a particular sympathy. On the other hand, later stages of development are dealt with very meagrely, and the descriptions of the origin of such organs as the lungs and prostate are far too slight to be of real use. It is strange, too, that a book which is primarily intended for medical men should provide so imperfect an explanation of the many malformations to which the various parts of the human body are liable.

A study of the text makes it very evident that Dr. Bryce has regarded a full and accurate description

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